

NASA TECH BRIEF

Ames Research Center



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Device for Measuring Electric Fields

The problem:

To measure low-intensity electric fields in space and in the presence of weak magnetic fields.

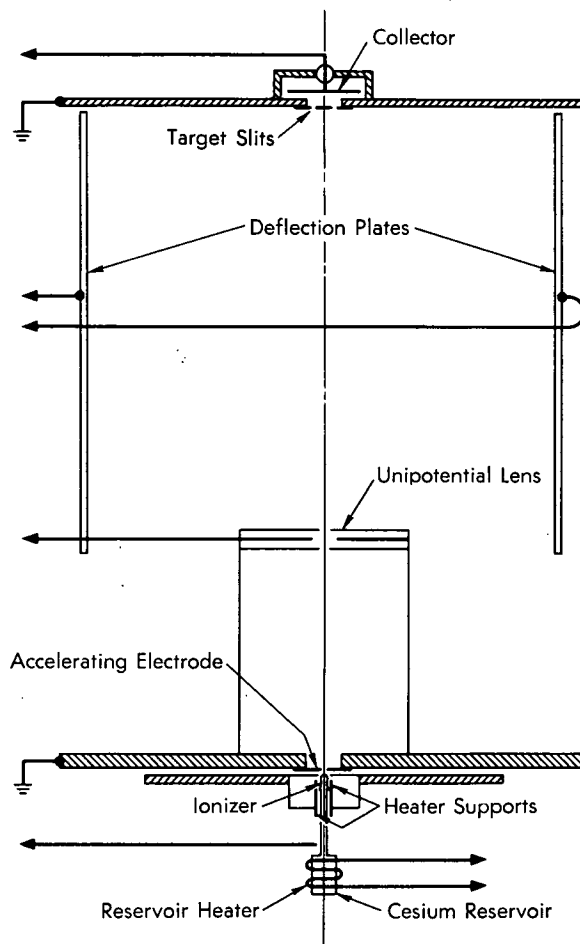
The solution:

A device which permits determination of the extent a beam of cesium ions is deflected by an electric field. In contrast with electrons, cesium ions are heavy enough to resist gross deflection by weak magnetic fields.

How it's done:

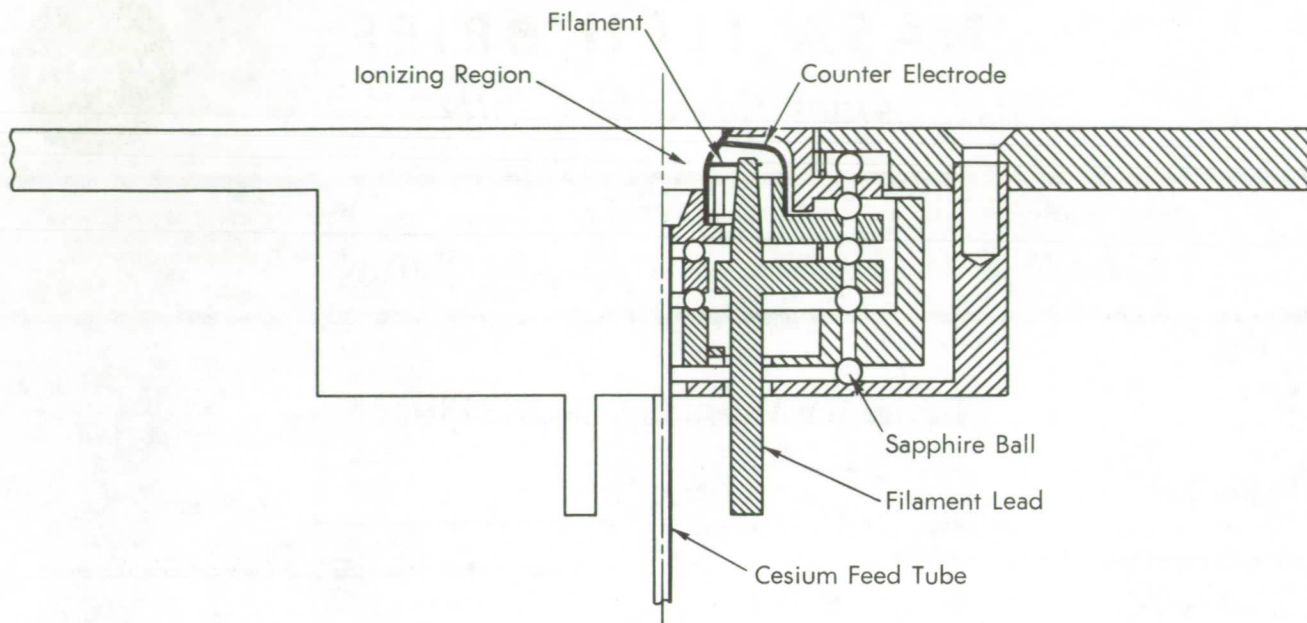
Passage of a thin, collimated sheet of cesium ions through a narrow target slit and onto a detector plate is maintained automatically by deflection plates charged to known potentials. Movement of the cesium ion beam away from the target slit because of an external electric field is prevented by an automatic adjustment of the potentials on the deflection plates; the potentials needed to keep the cesium ion sheet centered in the target slit are relatable to the strength of the external field; the direction of the field can be established by appropriately orienting the device within the field.

Successful operation of the device depends upon the generation of an intense, sharply-focused sheet of cesium ions with a very narrow Gaussian energy distribution; typically, the beam width at half-maximum is equal to the width of the resolving slit. The cesium ion source found suitable for the measurement of electric fields contains two 0.13-mm tungsten-3% rhenium filaments as electron emitters; the ionizing region (supplied with cesium vapor) is heated by bombardment with electrons accelerated toward it from the filaments. Cesium ions formed in the



ionizing region are drawn through a slit and accelerated toward a beam-defining unipotential lens system before passage between the deflecting plates which direct the ion sheet into the target slit located

(continued overleaf)



about 25 cm away from the exit pupil of the uni-potential system.

With a 0.38-mm target slit and a beam current of 6 picoamperes (21-volt acceleration), field strengths as low as 0.035 volt/meter can be measured; greater sensitivity can be realized with smaller slits and other refinements.

Notes:

1. Power requirement for the source is less than 5 watts, depending on the shape of the filament and the material of construction. Heating the ionizing region by radiation is less efficient than by electron bombardment.
2. The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price \$6.00
(or microfiche \$0.65)

Reference: NASA CR-73177, Flight Model Cesium Ion Source for Electric Field Measuring Instrument.

3. Requests for further information may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: TSP72-10148

Patent status:

No patent action is contemplated by NASA.

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